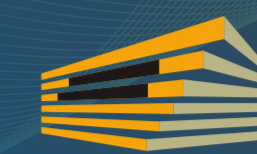


Software for collecting and assessment of kinematic data from different muscle groups



TYPE OF R+D RESULT

- New technology
- New product**
- New service
- New knowledge or skill



COMMERCIAL MATURITY LEVEL

- Model or conceptual idea
- Proof of concept (design)**
- Validated in a controlled environment
- Validated in a real environment
- Successfully implanted



PROTECTION LEVEL

- Non-applicable
- Patent**
- Software
- Know-how
- Utility model

Description of the solution. Problem solved

Human motion is the result of a set of a complex series of orders sent from the brain and executed by the muscle system. These movements can be captured by different types of available sensors (accelerometers, tactile screens, digitising tablets, cameras and microphones, among many others).

When an individual suffers from a degenerative disease or development disorders, muscle response and/or synchronisation of the orders sent by the brain may be affected, and their effects may be reflected in movement. Depending on the type of disease, motor deterioration can be demonstrated or it can affect in different ways to different types of movements. For example, in some cases voice can be considerably affected, while in other writing problems may arise.

Present at least two tasks from different modalities (writing, speaking, moving) on the tablet

Provide a stimulus on the tablet to start the activity

Carry out the tasks by the subject and obtain kinematic data through the tasks performed on the device

Generate a file with the kinematic and subject information

Process the information and obtain results

Analysis of results by the doctor or specialist

This software, developed in collaboration with the University of Montreal, allows to use the different sensors available in any current smart device (such as microphone, tactile screen and accelerometers) for programming similar activities that help to compare the different motor responses. This software, which is executed by an app that can be downloaded directly to a smart device or from a web platform, uses its own methodology that undertakes three types of tests based on voice, writing and movement analysis:

1. **Handwriting** (a través de la pantalla táctil).
2. **Voice** (via the device microphone).
3. **User's natural movements** (Via the device accelerometer).

Using these tests, the system quantifies the patient's time for reaction, how the orders are sent to the brain and what the response.

of the muscular system is. In addition to this, order and complexity of the tasks can be changed, introducing new goals that increasingly become more difficult in order to get the maximum amount of information about the user; thus, carrying out an evaluation of the patient within an established time framework (15 or 30 minutes). Time can be measured by a timer in the tactile screen.

Information processing and storage is done directly in the smart device (storage may also be transferred to the cloud.)

Thus, the software allows to assess remotely the evolution of any neuromotor disease and monitor the effect of any treatment by evaluating different features (voice, handwriting and gestures).

Besides, this solution provides a large database of different patient groups without needing to register personal information about the users, since each file is tagged with a reference, the date and the smart device identifier used for measuring.

Fields of commercial application

- **I+D sector:** technological centres specialised in neurodegenerative diseases. Using this solution combined with existing ones would help to develop new models for preventing mental and neurodegenerative diseases.
- **Health sector:** health and socio-health centres. Health services (public and private) could apply this system for improving early detection services for the aforementioned type of diseases, and it would be not necessary for patients to go to the doctor. Also, it could be used for monitoring progression of these pathologies remotely.
- **Sport or accident rehabilitation:** this software may be used for providing objective data about the patients' rehabilitation outcomes, sharing information that cannot be seen by them during their rehabilitation process.
- **Education:** this method enables objective detection of learning difficulties such as ADHD, ASD and lack of coordination.

Market opportunity

According to the Spanish Strategy in Neurodegenerative Diseases of the National Health System, neurodegenerative diseases are becoming more common due to the ageing of the Spanish popula-

tion, generating high prevalence and social cost. These diseases, including Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease (HD) and amyotrophic lateral sclerosis (ALS) have significant socio-economic implications, since they generate a relevant incapacity for work as well as a major economic expense due to the social and health care for all these people.

Many of these neurodegenerative diseases are related to age; therefore, the incredibly rapid ageing of population implies an increase of the prevalence of such pathologies. According to data of the Spanish Alzheimer's Confederation (CEAFA), more than 1.2 million people is affected by this disease in Spain. Taking into account the current trend towards an ageing population of the country, projections indicate that in less than 15 years, people suffering from Alzheimer will be over 7 million of patients.

This increase in the number of patients would have severe consequences, not only for patients and their families, but also for the sustainability of the national healthcare system. In the light of costs criteria, dementias are considered as the third cost cause behind cancer and cardiovascular diseases. Expenses generated by dementia are incremented according to its severity, the presence of related diseases and neuro-psychiatric disorders. In Spain, most of the expense caused by dementia is costed by the patient's family. According to estimations, the total cost in both public and private fields would rise to €48,000 million in a few years.

In view of the above, the solution hereby proposed would contribute to improve social and health care of patients and their families, making the work of professionals taking care of them easier.

In this sense, this solution may help in early diagnosing of patients with neurodegenerative diseases, which has significant benefits such as use of non-pharmacological treatment; planning the most appropriate psychosocial intervention; making easier decision making for families about social and healthcare issues related to the patient or the healthcare costs generated by home care or specialised services.

Competitive advantage

This software offers relevant advantages compared to other current systems for patient monitoring:

- **Easy to use** > Patients can use it just by using a mobile device.

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- **Safe data collection** > It allows to create a large database in a simple way without putting users' personal information at risk.
- **Quick results** > Processing of data is done directly inside the device.
- **Multifunctional** > Speech kinematics, natural movements and handwriting can be assessed by the same series of tests.
- **Remote and/or offline use** > It is possible to obtain patients' parameters directly on a tablet, without needing remote connection. Remote monitoring is also available
- **Widely applicable** > It can be used for studying patients suffering from ADHD, ALS, Parkinson and other neurodegenerative diseases.
- **It is a non-invasive solution** for the patient.

Name of the patent METHODS AND SYSTEMS FOR THE ACQUISITION OF KINEMATIC DATA FOR NEUROMOTOR ASSESSMENT
File number US37/481.966; CA2020/051372
Filing date
Patent grant status Request
Places where the patent is granted United States of America and Canada